OPERATIONAL ART CONSIDERATIONS FOR ARMY AIR AND MISSILE DEFENSE: LESSONS FROM THE OCTOBER WAR

A MONOGRAPH
BY
MAJ WILLIAM A. SPEIER, III
AIR DEFENSE ARTILLERY

School of Advanced Military Studies
United States Army Command and General Staff College
Fort Leavenworth, Kansas

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Major William A. Speier, III

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Approved by:

_____,Monograph Director
LTC Jeffrey R. Witsken, MMAS

_____, Director, School of Advanced
Robert H. Berlin, Ph.D Military Studies

Accepted this 22nd day of May 2003 by:

_____, Director, Graduate Degree Programs
Philip J. Brookes, Ph.D.

The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

OPERATIONAL ART CONSIDERATIONS FOR ARMY AIR AND MISSILE DEFENSE: LESSONS FROM THE OCTOBER WAR by Major William A. Speier, USA, 57 pages.

United States Army air and missile defense forces achieved tremendous operational success during Operation Iraqi Freedom. They also experienced tragic tactical failure with the fratricide of several coalition aircraft. These tactical failures may dominate lessoned learned from the conflict and conceal the significant operational considerations. The Operation Iraqi Freedom operational plan probably challenged many air and missile defender's conceptual models. Past experience and current air and missile defense doctrine promote force protection as the primary role of U.S. Army air and missile defense. Operations in Iraq pushed the air and missile defense system to give the joint force command freedom of action *and* force protection. This, undoubtedly, created cognitive tension within the air and missile defense community. This is good for the service and must be captured within air and missile defense doctrine.

The purpose of this monograph is to determine whether or not Army air and missile defense planning and employment--air and missile defense design--has an operational art cognitive foundation. It combines the theory of operational art with a case study analysis of the 1973 Arab Israeli War and an assessment of current air and missile defense doctrine to answer this thesis question.

Systems theory is the foundation of operational art. Therefore, the U.S. Army air and missile defense system merits are established first using complex adaptive systems evaluation criteria. An evaluation operational art theory and current joint and service operational doctrine establishes the operational art criteria. The operational design methodology provided within current joint and service doctrine forms the basis of these criteria. A case study of the 1973 Arab-Israeli War provides specific historical air and missile operational art lessons. Current joint and service air and missile defense doctrine is evaluated using lessons from the 1973 Arab-Israeli War and the operational design criteria. The final assessment is that current air and missile defense doctrine lacks operational art cognition and risk repeating Egypt's mistakes from the 1973 war.

This study results in recommendations to improve Army air and missile defense doctrine. JP 3.0, JP 5.0, JP 5-00.1, FM 3.0, and FM 5.0 provide the tools needed for Army air and missile defense doctrine to fully realize an operational art cognitive foundation. These tools are the operational design methodology contained in current joint and service doctrine. Our ability to replicate the success of Operation Iraqi Freedom depends on an Army air and missile defense doctrinal recognition of operational art by adopting the operational design tools provided in current joint and service operational doctrine.

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CHAPTER 1

INTRODUCTION

> Without operational art, war would be a set of disconnected engagements with relative attrition the only measure of success. - FM 3.0

Purpose

Transformation is currently consuming a large amount of mental energy within the services. From the top civilian leadership to each service component, the entire Department of Defense is moving down an ambiguous path towards a more capable force designed to meet a myriad of contingencies. No longer is there the monolithic Soviet threat serving as our organizational structure and design guidepost. Regardless what the force eventually "transforms" into, the theory of operational art will remain our key mental model for arranging forces in time, space, and purpose. It will, as Carl von Clausewitz's described the role of theory in On War "educate the mind of the future commander . . . to guide him in his self-education."[1] As stated by Dr. Bruce Menning in Operational Art's Origins, "Because this concept [operational art] is such an important one, the Army must continue relating tactical means to ever changing strategic ends, thereby providing a frame work for large operations should they every arise."[2] This monograph does not add to the flood of literature on Army Transformation.

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[1]Carl von Clausewitz, *On War*, ed. by Michael Howard and Peter Paret (Toronto, Everyman's Library, 1993), 163.

[2]Bruce W. Menning, "Operational Art's Origins," *Military Review*, September - October 1997, 1.

Although related to transformation, the purpose of this monograph is more fundamental in its approach. Army air and missile defense currently lacks an operational art cognitive foundation within its doctrine. The primary way the U.S. military expresses operational art is through operational design.[3] Field Manual (FM) 44-100, *U.S. Army Air and Missile Defense Operations*, states "commander must use the same types of planning processes used by supported force."[4] As such, Army air and missile defense design should incorporate the operational design methodology as provided in current Joint and Army doctrine. Yet, FM 44-100 goes on to state air and missile defense commanders use air and missile defense employment principles and guidelines to design their air and missile defenses.[5] These principles and guidelines are not adequate tools for air and missile defense planners at the operational level to develop plans nested with their supported commanders. The purpose of this paper is to examine the role of air and missile defense planning and employment within the context of operational art. The specific research question this monograph seeks to answer is whether or not Army air and missile defense planning and employment--air and missile defense design--has an operational art cognitive foundation.

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[3]U.S. Department of the Army Field Manual 3.0, *Operations*, June 2001, 2-4, and Joint Publication 5-00.1, *Joint Doctrine for Campaign Planning* (Washington, D.C.: Government Printing Office, 2002), viii.

[4]U.S. Department of the Army Field Manual 44-100, *U.S. Army Air and Missile Defense Operations, Planning (*Washington, D.C.: Government Printing Office, 2000), 4-21.

[5]Ibid., 4-21.

The degree to which air and missile defense planning and employment is consistent with operational art is relevant for three reasons. First, an air and missile defense design conceived within in the operational art context will realize the full potential of air and missile defense capabilities across the full spectrum of operations. Second, the evolving threat environment is changing the nature of force protection. Fixed wing and rotary wing threats are declining due to the high cost to train and maintain a viable force.[6] The ballistic missile threat will most likely increase in a regional context, but the threat against the American homeland will remain limited.[7] Cruise missiles and unmanned aerial vehicles are ascending to the top of the threat ladder due to their low cost, availability, and ease of maintenance.[8] Finally, tenets, or elements of operational art, are codified in joint and service doctrine. Subsequently, it must be similarly accepted in functional doctrine.

Although this monograph's lens is focused on operational art from an air and missile defense perspective, there is a likelihood this research may be equally applicable to other functional areas within the Army. Mr. Richard D. Newton from the Joint Special Operations University (JSOU) on Joint Special Operations Forces (SOF) stressed a lack of operational art comprehension within the SOF community as significant during recent Operation Enduring Freedom campaign planning. He stated the experience and education

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[6]Ibid., 2-1.

[7]U.S. Central Intelligence Agency, *National Intelligence Estimate 1999 Report*; available from http://www.cia.gov/cia/publications/nie/nie99msl.html#rtoc2; accessed 30 January 2003.

[8]U.S. Department of the Army Field Manual 44-100, *U.S. Army Air and Missile Defense Operations*, (Washington, D.C.: Government Printing Office, 2000), 2-1.

of SOF planners were limited to the tactical level of war fighting and did not prepare them to successfully plan and execute an operational campaign plan.[9]

Study Methodology

The basic methodology this monograph uses is an examination of the theory, history, and doctrine of operational art in respect to air and missile defense. Specifically, this monograph seeks to answer whether or not Army air and missile defense has an operational art cognitive foundation.

This monograph begins with a study of complex adaptive systems theory as described by Mr. Dietrich Dorner and Mr. Peter Senge. The key elements that comprise a complex adaptive military system are defined in accordance with their theories and the first set of evaluation criteria is then presented. These "systems" criteria are then applied to Army air and missile defense in order to establish its merit as a distinct system worthy of continued study to determine its operational art cognitive basis.

After determining Army air and missile defense merits as a system, a thorough analysis of operational art theory is conducted. The works of Mr. Shimon Naveh and Dr. James J. Schneider are used to provide the operational art theoretical basis for this monograph. The key elements of operational art as described by Mr. Naveh and Mr. Schneider are then compared with current joint and Army operational doctrine to

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[9]Comments are from a lecture given by Mr. Richard D. Newton on special forces planning implications and design at the operational level to the School of Advance Military Studies students given on 19 February 2003. Mr. Newton approved release of lecture content to the author on 19 February 2003.

determine how well our doctrine translates operational art theory. It is from this comparison the second set of evaluation criteria are established.

The second set of evaluation criterion, labeled operational design criteria, is then used in a case study analysis of the 1973 Arab-Israeli war. After a brief historical overview of the war, the operational design criteria are used to assess the Egyptian surface to air missile (SAMS) planning and employment. This case study provides possible air and missile defense planning and employment and operational art considerations to be applied to current U.S. Army air and missile defense design.

The case study is followed by an analysis of current U.S. Army air and missile defense doctrine; Joint Publication (JP) 3-01, Joint Integrated Air and Missile Defense System (JIADS), FM 44-100, and FM 44-94. This doctrine is assessed using the operational design evaluation criteria previously defined and used in the 1973 Arab-Israeli war case study. The lessons learned from the case study are also considered in relationship to current air and missile defense doctrine. Additionally, feedback from the Army Battle Command Training Program is used to determine how well air and missile defense planning and employment doctrine is applied at brigade and corps levels. This is followed by a synthesis of operational art theory, history, and doctrine in relationship to air and missile defense. A brief evaluation of recent events in Operation Iraqi freedom is included in the synthesis to assess the current status of air and missile defense design.

The monograph concludes with recommendations to improve the air and missile defense doctrinal construct so as to embrace the elements of operational design. Based upon the tools currently available in joint and Army Operations doctrine and

demonstrated in the 1973 Arab-Israeli War, an air and missile defense operational design methodology is offered that embodies the elements of operational design.

Evaluation Criteria

The first evaluation criterion used to assess how well air and missile defense planning and employment embody the elements of operational art is "systems orientation." The basis of operational art lies in the "universal phenomenon of systems."[10] Therefore, air and missile defense must conform to the three sub-elements of complexity, adaptive, and systems in order to warrant further examination. These criteria are defined and assessed in the beginning of Chapter Two.

The second criterion upon which to evaluate air and missile defense is "operational design." The evaluation criteria for operational design is derived in latter part of chapter 2 from an examination of operational art theory as explained by Mr. Shimon Naveh, and current operational joint and service doctrine. Evidence that operational design considerations exist within air and missile defense planning and employment is gathered from an examination of air and missile defense doctrine and Brigade and Corps Training Program (BCTP) trend analysis. This criterion is both quantitative and qualitative in that it seeks to determine how often and how well these tenets are incorporated.

[10]Shimon Naveh, *In Pursuit of Military Excellence: The Evolution of Operational Theory* (London: Frank Cass Publishers, 1997), 3.

Structure

This monograph contains five chapters. The introductory chapter establishes the monograph research question, study methodology, evaluation criteria, and monograph structure.

Chapter Two establishes the theoretical basis for the remainder of the monograph. It contains a study complex adaptive systems theory and operational art theory. The monograph evaluation criteria are defined in this chapter from theory and current operational doctrine.

Chapter Three is the 1973 Arab-Israeli war case study. It begins with an overview of the war, followed by an in-depth study of the Egyptian Surface to Air Missile System (SAMS) planning and employment. The Egyptian system is evaluated in accordance with the elements of operational design as defined in the chapter 2. The chapter concludes with a consideration of possible lessons to be applied to current air and missile defense doctrine.

Chapter Four analyzes current joint and Army air and missile defense doctrine using lessons learned from the case study and operational design evaluation criteria.

Chapter Five is recommendations to improve the air and missile defense doctrinal construct so as to embrace the elements of operational design. Based upon the tools currently available in joint and Army Operations doctrine and demonstrated in the 1973 Arab-Israeli War, an air and missile defense operational design methodology is offered that embodies the elements of operational design.

CHAPTER 2

OPERATIONAL ART

This chapter establishes the theoretical basis and evaluation criteria for the remainder of the monograph. It analyzes operational art theory and compares it to current joint and service operational doctrine. It begins with a study of systems theory as described by Mr. Peter Senge and Mr. Dietrich Dorner. The first set of evaluation criteria, systems orientation, is defined and applied to air and missile defense to establish its merit as a distinct system worthy of continued study to determine its operational art cognitive foundation. After establishing the validity of studying air and missile defense as a distinct system, the remainder of the chapter is dedicated to establishing the key operational art criterion against which to test the monograph thesis in subsequent chapters. Do this by examining the theories of Mr. Shimon Naveh and Dr. James J. Schneider, and comparing them with current joint and service operational doctrine.

Complex Adaptive Systems

The following section is a study of complex adaptive systems. It defines systems theory according to Mr. Dietrich Dorner and Mr. Peter Senge, establishes the first set of evaluation criteria, and evaluates air and missile defense as a system.

The first set of evaluation criteria is based upon system's theory. The foundation of operational art is systems thinking, and as such, any consideration of air and missile defense's operational art cognitive basis must begin with an assessment of air and missile

defense as a distinct system. The three evaluation criterion that comprise systems orientation are systems, complexity, and adaptiveness. These three criterion are considered that order, simultaneously evaluating air and missile defense.

The first systems orientation evaluation criterion is systems. Dietrich Dorner in, *The Logic of Failure,* defines a system as "A network of many variables in causal relationships to one another."[11] Therefore, the two main attributes of a system are its *variables* and their *causal relationships.* Peter Senge's, *The Fifth Discipline,* states "system thinking is seeing wholes."[12] This indicates systems are distinct enteritis occupying some recognizable form. A combination of Dorner and Senge's definitions supports Thomas K. Adams' more complete definition, "A system is a group of interacting parts functioning as a whole and distinguishable from its surroundings by recognizable boundaries. Ordinary observation tells us the Army is a system."[13]

As Lieutenant Colonel (Retired) Adams states, "The Army is an obvious system." Does this support the relevance of air and missile defense as a distinct system within the Army? The possibility exists to dissect a system into subsystems down to a molecular level. As Mr. Senge points out, "It is not enough to just see the forest for the trees." Systems thinking requires seeing the forest and the trees, and finding the important

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[11]Dietrich Dorner, *The Logic of Failure: Why Things Go Wrong and What We Can Do to Make Them Right*, 1989, 73.

[12]Peter Senge, *The Fifth Discipline: The Art and Practice of the Learning Organization (*New York: Currency Doubleday, 1990), 68.

[13]Thomas K. Adams, "The Real Military Revolution," *Parameters*, Autumn 2000, 3.

trees.[14] Dr. Joe Strange's concept of critical vulnerabilities as they relate to centers of gravity helps answer this question.[15] Dr. Strange defines a center of gravity as "primary sources of moral or physical strength, power, and resistance."[16] This is not inconsistent with our doctrinal definition, "Centers of gravity are those characteristics, capabilities, or localities from which a military force derives its freedom of action, physical strength, or will to fight."[17] Dr. Strange defines a critical capability as "primary abilities which merits a Center of Gravity to be identified as such in the context of a given scenario, situation or mission."[18] Therefore, the relevance of air and missile defense as a subsystem within the Army systems (which is a subsystem of the joint services, which is a subsystem of the U.S. national defense structure, etc.) is directly proportional to its contribution as either a center of gravity or critical capability in support of a center of gravity. At a minimum, air and missile defense provides critical capabilities to the Army and joint services. It directly contributes to our ability to gain and maintain air superiority, absolutely vital to the joint force fight. Additionally, it is the only system capable of defeating a ballistic

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[14]Peter Senge, *The Fifth Discipline: The Art and Practice of the Learning Organization (* New York: Currency Doubleday, 1990), chapter eight.

[15]Joe Strange, "Centers of Gravity & Critical Vulnerabilities: Building on the Clausewitzian Foundation So That We Can All Speek the Same Language," *Perspectives on Warfighting*, no. 4 (996), Marine War College, 1996.

[16]Ibid., 43.

[17]U.S. Department of the Army Field Manual 3.0, Operations, (Washington, D.C.: Government Printing Office, 2001), 5-7.

[18]Joe Strange, "Centers of Gravity & Critical Vulnerabilities: Building on the Clausewitzian Foundation So That We Can All Speek the Same Language," *Perspectives on Warfighting*, no. 4 (996), Marine War College, 1996, 43.

missile threat after launch. It also contributes to the joint force command, control, communications, computers, and integration (C4I) architecture, providing the only ground based capable sensor network that facilitates airspace command, control, and situational awareness. As critical capabilities, there is sufficient justification to study air and missile defense as a system.

The second systems orientation evaluation criterion is complexity. Complexity is defined as many independent variables within a system.[19] A system becomes more complex the greater the number of variables and increasing levels of interdependence. Clearly an air and missile defense system enjoys an enormous level of complexity. Using the DTLOMS (doctrine, training, leadership, organization, material, and soldiers) methodology of analyzing the system reveals just how much complexity is present, vertically and horizontally. Doctrine spans all levels of war from individual soldier tasks, collective unit task, operational planning and employment, and joint integration at the strategic level. Likewise, training, leadership, and soldiers equally span horizontally and vertically across the three levels of war. Focusing on the organization and material elements of DTLOMS provides quantifiable and consistent sets of variables upon which to assess a system. A generic set of variables for a typical air and missile defense system include: fire units, comprising a missile and launcher, radars; a power source; manpower; command and control; and logistics. These variables must rely upon each other in order for the system to function properly, demonstrating interdependence.

[19]Dietrich Dorner, *The Logic of Failure: Why Things Go Wrong and What We Can Do to Make Them Right*, 1989, 38.

Considering just the quantity of variables and their causal relationships only indicates a static or "detailed"[20] complexity. Viewing a system over time and space reveals the "dynamic"[21] nature of systems, which is how systems that matter behave according to both Senge and Dorner. Systems are not static. They are constantly moving. Interaction among variables capable of moving of their own free will in time and space creates a dynamic complexity that masks the true nature of a system. Mr. Senge claims "seeing interrelationships rather than linear cause and effect chains, and the process of change rather than snapshots" is the key to understanding complex systems."[22] Warfare by its nature is a dynamic environment. As LTC Adams states, "military conflict is actually a set of complex, interdependent behaviors that are constantly in flux."[23] Air and missile defense systems clearly exhibit all the elements of a dynamic complex system. Interdependent variables are present, translating inputs such as energy, logistics, and intelligence into outputs such as engagements or movement in the chaotic environment of warfare.

The final systems orientation evaluation criteria an air and missile defense system must meet is its ability to adapt in a complex and dynamic environment. System adaptability is a function of its feedback mechanism. Senge and Dorner are nearly

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[20]Peter Senge, *The Fifth Discipline: The Art and Practice of the Learning Organization (*New York: Currency Doubleday, 1990), 71.

[21]Ibid., 71.

[22]Ibid., 73.

[23]Thomas K. Adams, "The Real Military Revolution", *Parameters*, U.S. Army War College Quarterly--Autumn 2000, 3.

identical on the two types of system's feedback. Dorner cites positive feedback as an increase in one part of the system translates into an overall system increase. This leads to destabilizing effects on the system. Senge's equivalent to Dorner's positive feedback is reinforcing feedback that results in system growth. This is not how successful air and missile defense systems ought to behave. For example, increasing the number of radars (input) does not necessarily equal more engagements (output). Similarly, increasing manpower does not necessarily equal greater mobility. Air and missile defense systems appear to model what Dorner calls a well-buffered system and what Senge calls a balanced system. Dorner's buffered system, or negative feedback, translates a decrease in one part of the system and an increase in another part. Senge's balanced system is goal oriented or stabilized. The key to both these definitions is the systems ability to maintain equilibrium (consistent output) as inputs vary. Successful air and missile defense systems possess stabilizing or buffering characteristics. Following the above examples, a loss of radar does not necessarily result in fewer engagements. Shifting coverage or providing a feed from another radar compensates for one lost radar. Similarly, increasing manpower (assuming the system was not undermanned to begin with) may result in less mobility, as more variables (vehicles and logistics) are required to support them.

Another way of expressing the two feedback mechanisms above is a system's ability to self-reorganize. In *Military Misfortunes*, Eliot Cohen and John Gooch describe military failure as a function of failing to learn, predict, and adapt. Therefore, a military system that can learn and predict is capable of adapting.[24] This supports the dynamic

[24]Eliot J. Cohen and John Gooch, *Military Misfortunes: The Anatomy of Failure in War*, (New York: The Free Press, 1990.)

nature of systems' complexity, accounting for system change over time. Learning is function of the past, while predicting pertains to future events. Adapting occurs in the present. The Scud engagements during Desert Storm are an excellent example of air and missile defense system learning, predicting, and adapting. By predicting that Saddam Hussein would use ballistic missiles against Israel in an attempt to destabilize the coalition against him, extensive research and development was conducted in order to learn how to transform a system designed for engaging fixed wing and rotary wing aircraft. The efforts were successful in adapting the system to engage ballistic missiles. Granted, it was a limited ability, but it served the overall system aim. Even though it was not a full proof solution, many Scuds impacted on Israeli soil. The limited ability was sufficient to keep Israel out of the fight and maintain the coalition.

The preceding section defined complex adaptive systems, established the first set of evaluation criteria, and evaluated air and missile defense as a system Sufficient evidence exists to prove air and missile defense is a complex adaptive system, therefore, it meets the first set of evaluation criteria. It possesses many interdependent variables which are capable of acting independently and distinguishable from the larger system in its form by its overall purpose or aim. Air and missile defense is an active system in that it changes over time, which gives it a dynamic nature. Finally, the potential exists for the system to adapt to its changing environment. This ability to adapt is the most significant feature of a military system, and will be demonstrated in the next chapter. "The brilliant adaptive capacities of Israeli commanders and the skill and raw courage of their men

redeemed the initial defeats of the first few days leaving Israel master of most of the battlefields by October 24 [1973]."[25]

Operational Art Theory

Having established air and missile defense as system, the following section will define operation art according to the theories of Mr. Shimon Naveh and Dr. James Schneider, compare operational art theory to current joint and service operational doctrine to determine how well our doctrine translates operational art theory, and establish the second set of evaluation criteria. The second set of evaluation criteria, labeled operational design, is based upon operational art theory and current operational doctrine. The theoretical basis for operational art is presented first, and then followed by current doctrine.

The theory of operational art as presented by Mr. Naveh is examined first. As stated earlier, Mr. Shimon Naveh maintains the theory of operational art is based upon system's theory. The most important aspect of a system is its aim. The aim gives the system its direction or purpose. It keeps all the variables aligned, acting in harmony with one another towards a common goal. The aim, according to Mr. Naveh, is positioned at the top of a hierarchical process. Tension arises in translating the system's aim, which is abstract by nature, into tasks for the individual elements of the system. In other words, tension exists in translating strategic aim into tactical tasks. The reason for this is because the aim is broad, covering the entire system, and not specific in nature. In Mr. Naveh's

[25]Ibid., 111.

words, "it is the cognitive compass."[26] Between the system's aim and tactical tasks lies operational art. The challenge of operational art is to translate the purely cognitive aim into specific mechanical tasks, which creates a cognitive tension.

As competing systems clash in a contest, their aims fall into two basic categories. The first category is the positive aim of disrupting the rival system. Disrupting the rival system is accomplished by operational shock. To generate operational shock is to exploit three potential system weaknesses. The first potential weakness is a systems greatest strength and weakness; adherence to its aim. Separating the command and control elements from the system will cause the system to disintegrate and collapse. The next potential system weakness is its "deep structure and hierarchical logic of action."[27] Striking deep into the rival system may also cause it to collapse. This refers to the frontal and depth attributes of a system. The frontal aspect of a system is the horizontal or linear part that absorbs or delivers the initial blow. This part of the system relies on attrition to accomplish its tasks, while the deep, or vertical, element relies on maneuver. Shock is also accomplished by striking the rival systems front (horizontal) and rear (vertical) simultaneously. This will create a dilemma for the rival system, leading to disintegration. Essential to all operations is the synergistic application of effects throughout the system. This includes combined arms effects at the tactical level, as well as the integration of larger units moving towards a common goal. Cooperation among the system's variables enables synergistic effects, or effects greater than the sum of its parts. The final way of creating operational shock revolves around the concept of center of gravity. By

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[26]Shimon Naveh, *In Pursuit of Military Excellence: The Evolution of Operational Theory*, (London: Frank Cass Publishers, 1997), 14.

determining a system's center of gravity, its strengths and weakness are also discovered. These are subsequently used to create an operational vulnerability, which is then exploited. Creating an operational vulnerability involves deception and surprise, or "cunning, which is the essence of operational art."[28]

The second aim category is protecting your own system, or the negative aim. As your system is attempting to shock the rival system, measures are taken to prevent the friendly system from being disrupted. This is what Mr. Naveh calls "the self-regulating aptitude of fighting systems."[29] As mentioned earlier, the ability to adapt to disturbances to the systems is critical to success.

The final element Mr. Naveh describes, as part of his operational art theory, is the quantity and quality of the species within a system. These are linked to the vertical and horizontal functions within a system. Quantity is reflected in the holding element, or frontal, while quality is required of the striking element, or depth. In consideration of which is the appropriate aim for the system, a preponderance of quantity promotes a negative aim. Conversely, the greater the level of quality in a system, the more the positive aim is recommended. These are, of course, considerations of the correlation of quantity and quality between two competing systems.

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[27]Ibid., 17.

[28] Ibid., 19.

[29] Ibid., 15.

The theory of operational art according to Dr. James J. Schneider is now examined. Dr. James J. Schneider's theory of operational art,[30] which preceded Mr. Naveh's in print by about nine years, contains many of the concepts presented by Mr. Naveh. Dr. Schneider's emphasis on the expanded battle space and the inability to attain decisive battle are somewhat unique from Mr. Naveh's theory. Additionally, Dr. Schneider's emphasis on the rise of logistics as the main operational consideration is something not equally addressed in Mr. Naveh's writings. The two are consistent in expressing operational art as a shift from the classical model of "strategy of a single point"[31] as described in Dr. Schneider's text, or tactical destruction in Mr. Naveh's work, to what Dr. Schneider's calls the "gaseous battlefield." Modern warfare is more akin to a fluid mechanics instead of the classical solid mechanics of the strategy of a single point, which equated force equal to torque. Success relied upon the ability to concentrate more force at a decisive point on the battlefield than your opponent. The ensuing results usually concluded the campaign. In the fluid mechanic analogy, military success is dependant upon the total amount of force in relationship to the total amount of area occupied. Since decisive battle is no longer possible, tactical engagements no longer determine the outcome of the campaign, modern campaigns must apply pressure across the entire battle space. Simultaneous and sequential operations are required to achieve the

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[30]James J Schneider, *Theoretical Paper No. 3: The Theory of Operational Art,* U.S. Army Command and General Staff College, Fort Leavenworth, KS, 1 March 1988, 15.

[31]James J Schneider, Theoretical *Paper No. 4, Vulcan's Anvil: The American Civil War and the Emergence of Operational Art*, U.S. Army Command and General Staff College, Fort Leavenworth, KS, 16 June 1991, 20.

desired end state, or system aim. Clearly, Dr. Schneider and Mr. Naveh are expressing the same fundamental aspects of operational art.

From the above discussion, the following are criterion considerations from operational art theory to compare with our joint and service doctrine.

The first is strategic aim, operational objectives, and tactical tasks. Tactical tasks are arranged in time and space to attain operational objectives, and operational objectives set the conditions that fulfill the strategic aim.

Second, operations must be expressed in time and space and express depth. The relationship between forces employed must be considered in terms of holding or striking forces. Key considerations here are simultaneous and sequential employment of forces, always seeking to gain synergistic effects.

Third is the quantity and quality of forces employed. This describes the characteristics of forces employed and determines the nature of the overall force structure, or system design. From these criterion, key strengths and weaknesses are derived, which translate into vulnerabilities. This leads to the final consideration.

The center of gravity of the force is the final operational art theory evaluation criteria. Identifying the center of gravity allows for identification of critical capabilities and vulnerabilities. This process applies equally to friendly and rival systems, which leads to a determination of where to strike the enemy and how to protect of the friendly. From these operations are arranged to exploit enemy vulnerabilities and protect friendly vulnerabilities in pursuit of the system's aim.

Joint Operational Doctrine

Joint and service doctrine is now compared to operational art theory as presented above. Joint operational doctrine is examined first, followed by army doctrine.

Operational art in joint doctrine is primarily expressed in Joint Publications (JP) 3.0, *Doctrine for Joint Operations*, JP 5.0, *Doctrine for Joint Planning*, and JP 5-00.1, *Joint Doctrine for Campaign Planning.* Section Five, Chapter III, of Joint Publication 3.0 contains the elements of joint operational art. As defined in this manual, "Operational art is the use of military forces to achieve strategic goals through the design, organization, integration, and conduct of strategies, campaigns, major operations, and battles."[32] The fourteen elements of operational art in joint doctrine are synergy, simultaneity and depth, anticipation, balance, leverage, timing and tempo, operational reach and approach, forces and functions, arranging operations, centers of gravity, direct versus indirect, decisive points, culmination, and termination. These are discussed below, and compared to operational art theory as previously described.

The aim, as expressed in operational art theory, is considered first. Although not specified directly under the section outlining operational art, the strategic estimate process described in the beginning of Chapter III, JP 3.0 serves this function. The strategic estimate requires, "Translation of national objectives to objectives applicable to the combatant command or theater."[33] JP 5.0 and JP 5.00-1 discuss this in great detail as part of the elements of campaign plan design. Therefore, joint doctrine accounts for this concept, albeit not directly under operational art. Furthermore, the definition of

[32]Joint Publication 3.0, *Doctrine for Joint Operations*, (Washington, D.C.: Government Printing Office, 2001), xii.

operational art specifies attaining *strategic goals*. Perhaps there is rhyme to the joint reasoning for not placing the aim as a tenet of operational art. Since the aim gives a force its purpose to exist, and it dominates all other considerations of operational art. Subsequently, it binds the fourteen elements as a whole. Just as that whole requires an overall orientation in order to succeed, declaring strategic guidance from the National Command Authority as the primary aim for the system seems to ignore the importance of how effectively a system adapts over time. Otherwise stated, this aim seems incomplete. No one will argue military forces are subordinate to their civil leaders, yet the military forces aim is more than just waiting for NCA guidance.

All of the elements listed in joint doctrine conform to operational art theory, some being a direct transfer of concepts in both naming convention and context. These are synergy, simultaneity and depth, and centers of gravity. All of these tenets positively affirm that joint doctrine has an operational art foundation. They answer the second operation art theory criterion of how operations are expressed in time and space, including a consideration of depth, and describes the relationship among forces, always seeking to achieve synergistic effects. Joint doctrine also answers the third and fourth operational art theory criterion; characteristics of forces, quantity and quality, centers of gravity, critical capabilities, vulnerabilities, and how forces are arranged. Perhaps the only shortcoming of joint operational art doctrine is that it lacks a unifying theory. This is the missing element discussed above regarding strategic guidance as the system's aim. The Marine Corps' concept of single battle grounded in maneuver warfare provides an

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[33]Ibid., III-3.

excellent example of a unifying theory to doctrinal planning and execution.[34] Joint doctrine lacks such a basis. The tenets may be true to operational art theory, yet they are in a sense a list of concepts to be plugged into a process, as required. This does yield a certain amount of flexibility in planning, but appears to risk misapplication of concepts in a disjointed fashion. Coincidentally, the Marine Corps' maneuver warfare doctrine appears to have a better appreciation of operational art theory as expressed by Mr. Naveh. Central to maneuver warfare doctrine is the relationship between maneuver, attrition, and disrupting the enemy. Consider the following definition, "Maneuver warfare is a warfighting philosophy that seeks to shatter the enemy's cohesion through a variety of rapid, focused, and unexpected actions which create a turbulent and rapidly deteriorating situation with which the enemy cannot cope."[35]

Army Operational Doctrine

The following section compares Army operational doctrine with operational art theory. Operational art in Army doctrine is primarily expressed in Field Manual (FM) 3.0, Operations, and FM 5.0, Army Planning and Orders Production. In the latter operational art is not specifically discussed, but the elements of operational design are thoroughly covered. Operational design is the medium through which strategy is translated into tactics, the language of operational art.

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[34]Marine Corps Warfighting Publication 5-1, *Marine Corps Planning Process*, (Washington, D.C.: Government Printing Office 2001).

[35]Marine Corps Doctrinal Publication 1, *Warfighting*, (Washington, D.C.: Government Printing Office 1997), 73.

FM 3.0's definition of operational art is identical to JP 3.0's. This is not the only commonality between joint and service doctrine. FM 3.0 is very consistent with joint doctrine's description of operational art. There are slight variations, such as in the definition of centers of gravity, which substitutes localities for sources of power from which an enemy draws their freedom of action, physical strength, or will to fight. Clearly the Army definition is an implicit acknowledgement of its role as the joint force's decisive ground element. Another significant variation, actually an addition to joint doctrine, is the concept of logical lines of operation. This appears to be the Army's response to the challenge of a decade of peacekeeping and low intensity conflict missions. The last significant difference between joint and service doctrine is that the Army does not provide a list of operational art tenets. The closest Army doctrine comes to providing a list is in the following section:

> Operational art helps commanders use resources efficiently and effectively to achieve strategic objectives. It includes employing military forces and arranging their efforts in time, space, and purpose. Operational art helps commanders understand the conditions for victory before seeking battle. It provides a framework to assist commanders in ordering their thoughts when designing campaigns and major operations. Without operational art, war would be a set of disconnected engagements with relative attrition the only measure of success. Operational art requires commanders who can visualize, anticipate, create, and seize opportunities. It is practiced not only by JFCs, but also by their senior staff officers and subordinate commanders.[36]

Beyond this, Army doctrine relies upon operational design to express operational art. The elements of operational design are end state and military conditions; center of gravity; decisive points and objectives; lines of operation; culminating point; operational reach,

[36]Field Manual 3.0, *Operations*, (Washington, D.C.: Government Printing Office, 2001), 2-4.

approach, and pauses; simultaneous and sequential operations; linear and nonlinear operations; and tempo. This design model is closer to operational art than that provided in JP 3.0 or JP 5.00-1, but it lacks their consideration of critical capabilities, critical vulnerabilities, and critical requirements. Finally, the same arguments made about joint doctrine lacking a unifying theory upon which to give the system its aim is equally applicable to Army doctrine.

Conclusion

The following evaluation criteria are used to evaluate the 1973 Arab-Israeli War and the U. S. Army air and missile defense system. The elements of operational design from FM 3.0 and FM 5.0 are more consistent with operational art theory than the joint doctrine tenets of operational art. Therefore, they form the core evaluation criteria. These are, however, not sufficient enough to encompass the totality of operational art theory. Therefore, two additional criterion sets are also included. They are the system's aim, and the center of gravity analytical tools of critical capabilities, critical requirements and critical vulnerabilities.

These eleven evaluation criteria capture the essence of operational art as defined by Mr. Naveh and Dr. Schneider and are consistent with current joint and service operational doctrine. They provide an objective basis upon which to evaluate the presence of operational art within air and missile defense both past and present.

CHAPTER 3

THE 1973 ARAB-ISRAELI WAR

It is often said the impact of organizational change is not truly known and understood until long after it comes to pass. Therefore, in order to gain a historical perspective of the significance of air and missile defense and operational art, a case study analysis will be done on the Arab-Israeli War of 1973. The focus will be on the Egyptian military system. There are several reasons why this conflict serves as an excellent laboratory to study operational art and air and missile defense planning and employment.

First, the 1973 war came after a six year "transformation" in the Egyptian military system. Having suffered a humiliating and costly defeat at the hands of Israelis in the 1967 Six Day War, Egypt took deliberate measures to reassert influence in the region in order to satisfy their national interests. Although Egypt focused their efforts on defeating a specific threat (Israel), as apposed to our capabilities based approach, the lessons learned will be equally applicable.

Second, the 1973 War is an excellent example of modern military systems clashing, adapting, or failing to adapt, as the case may be. Of particular value to this monograph is the fact that it pitted "strength against strength"--that is, the Israeli Air Force against the Egyptian SAMS. In current terminology this would be considered an asymmetric conflict.

The final reason for selecting this conflict versus the American experience in Desert Storm, was the fact that the United States air and missile defense system was not seriously challenged in Desert Storm. The Iraqi air force had a negligible impact on disrupting the coalition. Although Scud missiles were launched, their effect was negligible. A study of that conflict from an air and missile defense perspective may provide a false impression of the true nature of operational art considerations for air and missile defense.

Overview

This section provides a general overview of the conflict. The information presented establishes the broader context necessary for the air and missile defense specific operational design evaluation which follows in the next section At approximately 1400 hours on 6 October 1973, Egypt and Syria launched a combined attack against Israel into the Sinai and Golan Heights. Using strategic surprise, the preemptive strike initially resulted in positive gains for the Arab nations as they seized lands denied them since the conclusion of the 1967 war. The war lasted until 24 October 1973, which halted primarily because of superpower intervention. Ultimately the war, although technically lost by the Arab nations, resulted in partial attainment of the Arab goals. These goals included Egypt resuming control of the Suez Canal, and the Arab nations united in liberating lands occupied by Israel and claimed by the Arabs; namely the Palestinian dominated areas of the West Bank and Gaza Strip. It also fulfilled two of Anwar Sadat's main objectives; restore Egyptian national self-confidence shattered by the complete defeat suffered during the 1967 war and remove the perception of Israeli dominance over Arab nations. These objectives were attained only because the superpowers, the United

States and the Soviet Union, intervened. Israel was poised to complete the destruction of the Egyptian Army and seize Cairo. The reason the Arabs and Egypt, in particular, lost the momentum gained from early success to the point of almost suffering another absolute defeat, is that Israel understood and practiced operational art better than the Arabs. It was not luck or which superpower backed their respective client state better that ultimately explained the outcome of events. Mistaken assumptions by both sides and Israel's ability to maneuver forces in time and space to accomplish its primary aim of national survival are the most important reasons the Arabs were thwarted in fully attaining their aims.

In Lieutenant General Saad El Shazly's own words, this was the Egyptian operational plan, code named Badr:

> One: Five infantry divisions, each reinforced with an armored brigade--plus extra subunits of ATGWs and portable SAMs drawn from other formations--to storm the Suez Canal along five sectors each three miles wide.
>
> Two: Objective: to destroy the Bar-lev line piecemeal and repel enemy counterattacks.
>
> Three: These divisional bridgeheads to penetrate to a depth of about five miles by H+18 to H+24 hours, each bridgehead then being about eight miles wide.
>
> Four: By H+48 hours, the divisions to have closed the gaps between their five bridgeheads to form two army-strength bridgeheads. By H+72 hours, these two Army to have joined into one armed forces bridgehead penetrating six to nine miles east of the canal.
>
> Five: Troops to dig in and assume the defense of these new positions.
>
> Six: Airborne and seaborne units to be used on a large scale to neutralize enemy HQs and to delay the approach of their reserves.[37]

[37]Saad El Shazly, *The Crossing of the Suez* (San Francisco: American Mideast Research, 1980), 36.

Lieutenant General Shazly, Chief of Staff for the Egyptian Army, maintained Egypt lacked the capability to conduct operations any deeper into to Sinai than allotted in the above plan. Despite this President Sadat directed them to develop a separate plan to attack towards the Giddi and Mitla passes. This was done principally to appease Syria in order to maintain the coalition. Lieutenant General Shazly stated, "I, nor any of my subordinates, dreamed the second phase would ever be carried out."[38] Major General Mohamed Abdel Ghani El-Gamasy, Director of Egyptian Operations, in his memoirs maintains he favored a continued offensive action, but had difficulty convincing General Ahmad Isma'il, Commander in Chief of Egyptian forces.[39] Major General El-Gamasy's position of seizing the passes was always part of the plan and necessary to defeat the Israeli army. Yet General Isma'il's position was closer to his chief of staff, despite a publicly known history of poor working relationships between the commander and his chief of staff.

The reason for this tension between the political aim and military objectives was a limitation of military means. As Major General D.K. Palit states in *Return to the Sinai*,

> But the realist kept in mind the limiting factor of the SAM cover. If the operation were to be guaranteed success, with no loopholes left for a characteristic mobile thrust by the enemy to breakthrough and round up the invading forces, the bridgehead would have to be limited to a depth of fifteen to twenty kilometers, the extent of the SAM cover.[40]

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[38] Ibid., 37.

[39]Mohamed Abdel Ghani El-Gamasy, *The October War* (Cairo, Egypt: The American University in Cairo Press, 1989), 260-275.

[40]D.K Palit, *Return to the Sinai: The Arab Offensive, October 1973* (Dehar Dun, New Delhi: Palit and Palit Publishers, 1974), 43.

Egypt was estimated to have 146 SAM batteries under the separate command of Major General Mohommed Ali Fahmy. Based upon lessons from the 1967 Six Day War, Egypt created a fixed wall of SA-2 and SA-3 sites designed to prevent Israeli aircraft from penetrating west of the canal. In total, Egypt received 880 launchers from the Soviets, eighty being the new and mobile SA-6. To compliment this high altitude defense system, Egypt fielded 2000 SA-7 Strella shoulder fired infrared missiles and 2,750 ZSU 23-4 antiaircraft gun systems for forward area defense. The SA-6 was Egypt's most capable missile system, which factored heavily in the course of events of the war. At conflict termination, Egypt lost forty-four SAM batteries, primarily the result of ground attacks after 14 October. The Egyptian air force totaled about 750 aircraft, but had limited effect on operations beyond the initial assaults across the canal. Egyptian aircraft included 160 Mig-21, 130 Su-7, 60 MiG-19, 200 MiG-17, 18 Tu-16, 30 Il-28, 70 MI-8, and 12-30 MI-6. Egypt lost 265 of these aircraft during the conflict, chiefly due to air-to-air engagements with the Israeli air force. A lack of training, coupled with an accurate perception of Israeli technological and tactical superiority in air forces, resulted in using the Egyptian air forces up to the limit of the SAM coverage in a close air support role.[41]

Israel, for its part, invested next to nothing in its air defenses. They relied on their aircraft to deliver air superiority. The American-made Hawk system was their sole high altitude defense system, which totaled seventy-five launchers. This limited quantity, however, was effective in altering Egyptian attack profiles away from areas they protected. The Israel air force was a mix of new American technology and older French

[41]Figures listed are from Trevor N. Dupuy's, *Elusive Victory: The Arab-Israeli Wars 1947-1974* (Fairfax, VA: Hero Books, 1984), 608-610.

aircraft. The F-4 Phantom was their main fighter-bomber, superior to anything supplied to Egypt from the Soviet Union. Beyond the 140 F-4s, Israel had 150 A-4 Skyhawks, 50 Mirages, and 12 Super Mysteres, totaling 476 aircraft including fixed wing and helicopters lift assets. Of these, Israel lost a total 109 aircraft during the war.[42]

Operational Art Assessment

The following section is and operational design evaluation of the 1973 Arab-Israeli War surface to air missile defense systems. This assessment is focused on the Egyptian air defense system as it factored in the planning and execution of the war.

President Anwar Sadat was clear in the direction he intended Egypt to take. Essentially, he wanted to unify the Arab world to defeat Israel. The means to attain this aim was his military forces combined with those of Syria, and hopefully Jordan and Iraq. The ways was a multi-front attack with limited objectives to seize the Suez Canal and Golan Heights, in conjunction with a guerrilla movement provided by the Palestinians in the West Bank and Gaza Strip. As stated earlier, tension arose from this aim in an effort to balance the military means available and maintaining the coalition support. Syria wanted more pressure on Israel in the Sinai in order to reduce pressure on the northern front. The Egyptian perception of Israel's aim was to maintain a position of strength in the region in order to impose its will on the Arab nations.

From Colonel Dupuy's, *Elusive Victory,* the Egyptian end state and military condition were "to defeat Israeli forces in the western Sinai by a deliberate assault crossing of the Suez Canal; to seize five or more bridgeheads ten to fifteen kilometers

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[42]Ibid.

deep on the eastern bank of the Canal; to repel Israeli counterattacks; to inflict maximum losses on the enemy; and to be prepared for further missions, depending on the success of this initial assault and concurrent Syrian operations."[43] Major General El-Gamasy assessed Israel's end state and military condition as "to force the Arab will to yield to its own so that peace could be imposed under Israeli conditions. This meant that Israel had to maintain military superiority to be able to impose the *fait accompli* in the occupied territories, and to prevent the Arabs from considering a comprehensive war by instilling in them a felling of futility, inadequacy, and despair."[44]

Egypt's center of gravity was its integrated aid defense system. This center of gravity also directly provided two critical vulnerabilities: a lack of mobility and a limited coverage beyond the Suez Canal from its fixed SA-2/3 sites. Critical capabilities included massed infantry with ATGWs, bridging assets, and armor reserve brigades. Perhaps the single greatest Egyptian critical requirement was Soviet support. It was the Soviets who equipped, trained, and maintained the Egyptian army. Obviously, this was a vulnerability as well. Despite having a numerical superiority on both the ground and in the air, the Egyptian's were tentative in using their air forces beyond SAMs coverage for fear of losing them to Israeli offensive counter air engagements.

The Egyptians viewed the Israeli air force as Israel's center of gravity. Supporting this center of gravity was the critical capabilities of qualitatively superior force in both air and ground forces; especially the mobile armor and artillery brigades that are better trained and fostered initiative. In order to be successful, Israel was dependant upon its

[43]Ibid., 390.

critical requirement to mobilize its reserve forces. Egypt mistakenly believed one of Israel's critical vulnerabilities was an aversion to losses. Israel was sensitive to losses because they were essentially irreplaceable. Losses, however, did not weaken Israel's resolve. Real vulnerabilities did exist due to long lines of communications, and an economy that could not sustain a prolonged conflict.

Egyptian decisive points, objectives, and line of operation started at its base in Cairo and ended fifteen to twenty kilometers east of the Suez Canal. Decisive points included its mobilization points, attack positions on the west side of the Suez Canal, the five crossing sites, the forty forts comprising the Bar-Lev line, the Gilda and Mitli passes, and the defensive positions on the east side of the Canal. From these decisive points, the objectives and line of operations was to mobilize its forces, strike deep into the Sinai with a preemptive air strike, suppress Israeli forces along the Bar-Lev line, conduct an assault crossing, defeat the Bar-Lev line forces and three armored brigades in the Sinai, occupy defense positions, and defeat the Israeli counterattack forces generated from the Israeli mobilization. Egyptian air defense decisive points are nested within this line of operation. Defeating the Israeli initial air strike was crucial for success. Providing low altitude air defense coverage forward for the assault crossing, protecting the crossing sites, and reposition coverage across the canal was also critical.

Egypt culminated when it was no longer capable of defending its gains or launching a counterattack to defeat the Israelis. This happened on 14 October, after the ill-fated offensive to seize the passes. Without air defense coverage, which also meant no

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[44]Mohamed Abdel Ghani El-Gamasy, *The October War* (Cairo, Egypt: The American University in Cairo Press, 1989), 128.

close air support, the six armored brigades sent into the desert were easy prey for the Israeli air force and mobile ground forces. Although the losses were not significant enough to bring Egypt to culmination, the situation created an opportunity for Israel to penetrate the Egyptian line north of the Bitter Lakes. The first objective after penetrating to the west side of the Canal was the SA-2/3 sites. This gap in the SAMs coverage was enough for the Israeli air force and ground forces to exploit the penetration and encircle the Third Army in the south. SAMs coverage forward would have denied the Israelis the ability to mass air on Egyptian forces advancing and allowed the Egyptian air forces to support the attack.

Despite the fact Egypt was capable of driving deeper into the Sinai with its armor brigades, its operational reach was limited to how far its SAMs coverage extended. Equally blunted were the air forces because air superiority only existed to the limits of the SAMS coverage. Although the Egyptians were capable of striking deep into the Sinai upon initiation of hostilities while the Israeli air force was caught on the ground, this was a one-time operation. Any airmobile forces inserted during this phase would have been isolated without logistical or fire support. This dictated a land centric approach due east across the canal. Clearly, the SAMs coverage dominated operational reach and approach considerations.

Beyond the simultaneous attacks among the coalition partners, the remainder of the operation was very sequential and linear, as outlined in the plan above from Lieutenant General Shazly. The air defense plan was equally sequential and linear. Because of SAMs coverage limitations, the plan was more sequential than it possibly needed to be. At the heart of Major General El-Gassamy's argument to maintain the

momentum gained by the initial assault crossing was that it was the only way to get deep enough into the Israeli system before they were capable of effectively massing mobilized forces. It also kept the Israeli's focused in the Sinai, which created a weaker front along the Golan Heights, increasing Syria's chances to succeed. More significantly, and not addressed in any of the Egyptian leadership memoirs, is continuing the offensive deeper into the Sinai would have reduced the risk of rapidly repositioning the most capable SA-6's versus waiting for optimal conditions on the far side objectives. A rapid advance of the SAMs coverage would have subsequently allowed the Egyptian air forces to support a ground advance, to the extent of the aircraft range. The synergistic effects of such a joint and combined arms advance would have expanded the Egyptian area of operations and generated more options. There is a likelihood it may also have sufficiently disrupted the Israeli system to result in a peace settlement on Arab terms. Fear of losing the SA-6s, however, prevented accepting such risk and dictated the sequential nature of the campaign.

Finally, as illustrated above, the SAMs coverage also dictated the tempo of the campaign. The initial phase was a violent execution of a well-rehearsed set piece plan. Once the initial military objective was achieved, however, the tension between strategic aim and military objectives brought the tempo to a complete halt. As Lieutenant General Shalzi and Major General El-Gassamy point out, there was a three-day operational pause from 11-14 October. Egypt actually achieved the desired military conditions from the first phase of the operations on 9 October, and waited for the anticipated Israeli counter attack instead of continuing the offensive deeper into the Sinai for the reasons stated above. The Israeli's mobilized while the Egyptian's waited. Subsequently, Egypt no

longer controlled the tempo, and allowed Israel to get insider their decision making cycle. Because the SAMs coverage was Egypt's center of gravity, it dictated the campaign's tempo.

Conclusion

From the strategic aim to the tempo of operations, SAMs coverage dominated the Egyptian planning and execution in the 1973 war. This was the result of a conscious effort to overcome the humiliating defeat of 1967. Egypt was determined to find a solution to the problem of Israeli air superiority in the region. Unfortunately, the solution they developed was not good enough to achieve the desired aim.

The argument has been made in this section that Egypt's failure is rooted in operational art shortcomings. It is somewhat ironic that the Soviets provide Egypt its equipment and training, but not its heritage of deep operations and successive battle. Be that as it may, these are the lessons to be learned from the Egyptian experience.

First, the strategic aim dictates the entire systems behavior. President Sadat provided clear and unambiguous guidance to his military leaders. When President Sadat directed them to prepare an option to go deeper into the Sinai, the military leadership should have aggressively sought a solution to make the ends, ways, means, and risk meet this aim. Yet they did not do this. Tension arose between the aim and the military objectives, resulting in a mismatch of tactical actions, military objectives, and end state. An aversion to placing the Egyptian center of gravity at risk is the primary reason this happened. Had they considered options to reduce this center of gravity's vulnerabilities, and subsequently reduced its risks, they could have married the ends, ways, and means to attain the strategic aim. This was attainable through operational design.

Second, the Egyptian air defense system had decisive points, objectives and a line of operation that supported the larger system. Instead of nesting these within the larger system, the SAMs coverage actually limited the Egyptian system. Success depended upon defeating the Israeli system before it reached its full potential. Yet consideration of placing forces in time and space was dictated by the limit of SAMs coverage. This eliminated striking deeper than the initial fifteen to twenty kilometers provided on the east side of the canal. Subsequently, the Egyptian's only possessed a frontal element to their system, unable to affect the massing Israeli mobilization. As the Israelis generated options, no such effort was proportionally available to the Egyptians. Had the Egyptians selected decisive points, objectives, and a line of operation for their air defense system that allowed them to expand their area of operations more rapidly, they may have maintained the tempo initiated during the first phase, and prevent their system from culminating.

Last, the approach chosen is understandable considering the environment in which the Egyptians operated. The operational reach and sequencing of operations, however, are not. In and of themselves, the Egyptian ground forces were not limited to a fifteen to twenty kilometers advance east of the canal. This was strictly a limitation based upon the SAMs coverage. Had the Egyptians been more aggressive in advancing their SAMs coverage, they could have maximized their reach and created opportunities for sequential operations. The synergistic effects of the SAMs coverage, air forces, and uncommitted armor reserves may have sufficiently disrupted the Israeli system before it was capable of reaching its full potential.

These three lessons provide two vital considerations for air and missile defense in relationship to operational art. First, operational art, as evaluated through the operational design criteria, absolutely applies to air and missile defense. This case study demonstrated that air and missile defense as a system contains all the elements of operational design. The second point derives directly from the first. Air and missile defense design must be "nested" with the broader operational design. That is, the air and missile defense design must support attaining the operational objectives and military conditions satisfying the strategic aim. In order to do this the other elements of operational design must equally nest with broader plan.

CHAPTER 4

AIR AND MISSILE DEFENSE DOCTRINE

This chapter evaluates air and missile defense joint and service doctrine according to the operational design criteria previously used to assess the 1973 War. Feedback from the Battle Command Training Program feedback is then used to assess air and missile defense design in corps, division, and brigade staff training. The chapter concludes by synthesizing the operational art theory, the 1973 War, and current air and missile defense doctrine. Current events from Operation Iraqi Freedom are included in an attempt to gather the most status of Army air and missile defense operations.

Two primary sources are consulted to assess joint air and missile defense doctrine. They are JP 3-01, *Joint Doctrine for Countering Air and Missile Threats*, and JIADS: *Multiservice Procedures for a Joint Integrated Air and Missile Defense System.*[45] Army air and missile defense sources include FM 44-100, *US Army Air and Missile Defense Operations*, and FM 44-94, *Army Air and Missile Defense Command Operations*. These four sources are assessed using the operational design criterion defined in chapter 2. This assessment is both quantitative and qualitative. It seeks quantitative evidence that the criterion are present in the sources, and qualitative evidence the context of criterion meanings are adequately conveyed. The chapter concludes with

[45]JIADS is referenced separately for each service component. The Army reference is FM 3-01.15 and will be listed as such in the bibliography.

an examination of Battle Command Training Program (BCTP) feedback on air and missile defense operations dating back to 1995.

Joint Air and Missile Defense Doctrine

This section assesses joint air and missile defense doctrine using the operational design criterion. JP 3-01 provides guidance on how to plan, coordinated, and conduct joint operations to counter air and missile threats. Center of Gravity is the only evaluation criterion specifically mentioned in this document. It is considered only within the J2 (intelligence) assessment of the enemy's center of gravity. It does not specify the purpose of identifying the center of gravity, beyond that it is a J2 function. This does not, arguably, capture the context of the meaning of center of gravity in relation to its operational art. Therefore, JP 3-01 lacks any specific reference to the operational design criterion.

JP 3-01 does contain elements of operational art even though it does not identify them as such. Perhaps the most valuable element of JP 3-01 is the conceptual model it contains describing the joint effort to counter air and missile threats. "The purpose of the joint counterair mission is to attain a desired degree of air superiority to allow freedom of action and protect the joint force."[46] This statement contains, in the broadest sense, both the systems aim and its desired military conditions and end state for a joint counterair effort. The aim is air superiority, and the military conditions and end state are freedom of action and force protection. JP 3-01 moves forward from this point and describes how the joint force is arrayed to achieve this aim and end state. Counterair operations are divided

[46]Department of Defense JP 3-01, *Joint Doctrine for Countering Air and Missile Threats* (Draft) (Washington, D.C.: Government Printing Office, 1999), v.

into offensive counterair and defensive counterair. "Offense Counterair (OCA) . . . is offensive operations to destroy, disrupt, or neutralize enemy aircraft, missiles, launch platforms, and their supporting structures and systems as close to their sources as possible."[47] "Defensive counterair (DCA) . . . is all defensive measures designed to detect, identify, intercept, and destroy or negate enemy forces attempting to attack or penetrate the friendly air environment."[48] The key distinction between OCA and DCA is where the action is taking place, friendly or enemy airspace, and is the action preemptive (offensive), or reactive (defensive). DCA is subsequently classified as active or passive air defense. JP 3-01 considers Army air and missile defense purely as an active air defense system. It acknowledges "DCA operations should attempt to intercept intruding enemy aircraft and missiles as early as possible" and "be conducted as far from the friendly operational area as possible," yet limits active air defense to the role of force protection only.[49] This is a curious omission of active air defense's role in the other desired military condition and/or end state, that is, providing the joint force commander freedom of action.

In addition to aim, military condition, and end state the JP 3-01 loosely describes lines of operations considerations in the introductory chapter as "US military forces must be capable of countering the air and missile threat from initial force projection through redeployment of friendly forces."[50] The last operational design criterion qualitatively

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[47] Ibid., I-2.
[48]Ibid., I-2.

[49]Ibid., V-6.

contained in JP 3-01 is friendly force's critical capabilities. These include aircraft, surface-to-air missiles, air-to-surface missiles, special operations forces, elements of information operations designed to counter the threat, sensors, and C4I systems.

JIADS is devoid of the operational design criterion. Despite a section dedicated to Army air defense operational planning this document is more useful for tactical employment. For example, consider the following area air and missile defense plan considerations:

1. Air Defense C2.
2. JFC's air defense priorities.
3. Sensor employment.
4. ID procedures.
5. Engagement procedures.
6. Airspace control procedures.
7. Weapons control procedures
8. Weapons systems employment
9. Tactical interface (for example, TADIL) design.
10. Dissemination of EW.
11. DAL.
12. Joint theater missile defense (JTMD) integration.
13. Maintenance scheduling.
14. Designation of RADCs/SADCs.[51]

These fourteen elements are designed to produce successful tactical engagements. An operational planner would be considerably challenged using these elements to develop a plan. For example, the commander's priorities do not necessarily translate into decisive points and objectives. They merely represent what is important to the commander,

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[50]Ibid., I-1.

[51]U.S. Department of the Army Field Manual 3-01.15.*Multiservice Procedures for a Joint Integrated Air Defense System,* (Washington, D.C.: Government Printing Office, 2001), II-8.

subsequently leaving it up to the operational planner to figure out what are the decisive points and objectives.

JIADS states the air and missile defense plan "is based upon the priorities and the concept of operations for land operations,"[52] opening the conceptual door for operational art considerations of air and missile defense planning. The door, however, is only slightly cracked open, because the remainder of the publication stresses the focus of Army air and missile defense is force protection. In fact, JIADS reinforces the tactical planning methodology described above in its operational planning process section. The primary considerations for air and missile defense plan development are assets to be protected and forces available to provide the protection. This appears to drive the defended asset list (DAL) methodology to planning. This methodology, at best, produces a tactical engagement plan instead of an air and missile defense plan that embodies considerations of operational art.

Army Air and Missile Defense Doctrine

This section assesses Army air and missile defense doctrine using the operational design criterion. FM 44-100 is the capstone doctrinal manual for Army air and missile defense operations. It describes Army air and missile defense operations across all levels of war--strategic, operational, and tactical. FM 44-100 is consistent with the joint doctrine as discussed above, and subsequently suffers similar shortcomings. It does offer consideration of strategic objectives, sequential and simultaneous operations, and tempo. These are, however, presented in a disjointed manner and not fully consistent within the

[52]Ibid., III-9.

context of the operational design criterion. For example, strategic objectives are geopolitical assets to be protected at the strategic level of war.[53] Linking a defended asset to a level of war, based upon the force defending it and its location on the battlefield, does not necessarily meet the definition of strategic aim, military conditions, and/or end state. This is a very narrow view as how to employ air and missile defense as a member of the joint fight to set military conditions, which are linked to satisfying the strategic aim. It limits the operational planner's options when considering how best to employ air and missile defense and creates the impression air and missile defense is best employed as a point defense asset. Similarly, discussion of simultaneous and sequential operations is equally shallow and inconsistent with FM 3.0's operational design definitions. FM 44-100 description of simultaneous operations is included in chapter four's planning considerations section. This section is conspicuously deficient the elements of operational design. The subsections of planning considerations are simultaneous operations, total mission awareness, teamwork, fundamentals, sequencing operations, deception, rehearsals, and weapons of mass destruction.[54] All valuable planning consideration for air and missile defense, yet beyond the simultaneous and sequencing operations sections, bear little relationship to the elements of operational design. The definitions presented also lack relative value in relationship to the elements of operational design. For example, simultaneous operations are described by the following statement. "Multiple types of

[53]U.S. Department of the Army Field Manual 44-100 U. S. *Army Air And Missile Defense Operations (*Washington, DC: Government Printing Office, 2000), 6-2.

[54]Ibid., 4-6 to 4-7.

operations go on simultaneously throughout the commander's battlespace."[55] The subsequent paragraphs explain the necessity to synchronize actions in accordance with the commander's vision and phasing operations. Absent from FM 44-100's discussion of simultaneous operations is the essence of FM 3.0's linkage of resources in time and space to accomplish a decisive results.

Consistent with the concepts presented in joint counterair doctrine, FM 44-100 defines "the mission of air defense artillery is to protect the force and selected geopolitical assets from aerial attack, missile attack, and surveillance."[56] It also states air and missile defense commanders allocate forces based upon the supported commander's priorities, critical assets, installations, and facilities. Air and missile defense priorities are determined by assessing a defended assets criticality, vulnerability, recuperability, and the threat directed against it. Conspicuously absent from any of these planning considerations is the other desired end state of joint counterair operations--freedom of action. Therefore, FM 44-100 encourages air and missile defense planners to do little more than develop a list of defended assets consistent with the supported commander's priorities and the concept of operations. When insufficient air and missile defense assets exist to protect the defended asset list, then the commander is asked to accept risk. As noted earlier, this is at best a tactical plan. It lacks recognition of the elements of operational design, both quantitatively and qualitatively.

Perhaps FM 44-100's major shortcoming as a tool for incorporating operational art into air and missile defense planning and employment is the primacy of force

[55]Ibid., 4-5.

protection as the air and missile defense system's aim. Within the manual are air and missile defense operational art gems that get washed away in the text. For example, under the planning considerations section is a paragraph describing how air and missile defense may contribute to deception operations. The value of this tiny section is lost in the vast ocean of text carried along by a strong current of force protection. This is unfortunate because herein lies a central argument for planning and employing air and missile defense in a manner that best contributes to meeting military conditions that fulfill strategic aims. In other words, without incorporating the elements of operational design, air and missile defense planning and employment lacks the tools necessary for cognizant application of operational art.

FM 44-94 primarily describes the roles and functions of the Army Air and Missile Defense Command (AAMDC). It contains five paragraphs, less than one page, describing air and missile defense planning. These five paragraphs are wholly consistent with FM 44-100 and joint doctrine for counterair. FM 44-94 contains the essence of these manuals in a much more concise package. Air and missile defense planning revolves around a defended asset list and forces available. Therefore, both a qualitative and quantitative recognition of the operational design criterion is absent.

Battle Command Training Program

This section assesses Army air and missile defense operations using feedback from the Battle Command Training Program. The Battle Command Training Program (BCTP) based out of Fort Leavenworth, Kansas, is the Army's capstone training center. From brigade through joint task force level, BCPT provides a venue to train and assess

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[56]Ibid., 1-2.

each command and staff's strengths and weaknesses against a real world and free playing opposing force. This program is uniquely designed to capture how well units conduct operational planning and execution. BCTP produces an annual collection of trends observed during the year called Perceptions. Comparing feedback from 1995 to 2002, an obvious trend is revealed in air and missile defense planning. Air and missile defense plans do not support the ground commanders' intent. The common threads from the annual reports include the following:

> JTF and ARFOR planning staff's are not knowledgeable of theater missile defense operations.
>
> Air and missile defense commanders and staff do not always validate and update air defense priorities that support higher headquarters'/ground commanders' decisions.
>
> Air and missile defense commanders do not mass air defense artillery assets at critical times and places on the battlefield for early engagement.
>
> Air and missile defense commanders do not anticipate future requirements or develop decision criteria to adjust the air defense plan to meet an evolving friendly and enemy situation.[57]

These comments substantiate the doctrinal shortcomings listed above. By emphasizing force protection and defended asset lists as the main air and missile defense planning considerations, the plans lack any connection with operational design? Lines of operation do not link the force from its base, to decisive points and objectives, to attaining the desired military condition and/or end state. If they did, then surely priorities would be adjusted in time, space, and mass. The other elements of operational design

[57]Battle Command Training Program, Perceptions, 1995-2002, available online at ftp://160.149.8.239. Accessed on February 6, 2003. Access granted by MAJ Joel L. Kain II, D/G3, BCTP.

would also direct the air and missile defense planning towards operational art. Yet the current air and missile doctrine is not sufficient enough to produce a plan that embodies operational art. The best that current doctrine can produce is a well-synchronized tactical engagement plan.

Conclusion

The following is a synthesis of operational art theory, history, and doctrine in relationship to air and missile defense. This synthesis includes a brief evaluation of recent events in Operation Iraqi Freedom assessing status of current air and missile defense design.

Army air and missile defense was established in the second chapter as a system. As a system it should contain operational art cognition. An operational art foundation currently exists in joint and service doctrine, making its absence in air and missile defense doctrine even more egregious. Failing to recognize this point can lead to devastating results as demonstrated in the 1973 War. Egypt's failure to nest its air and missile defense design within its overall operational design resulted in a mismatch between tactical tasks, operational objectives, and strategic aim. That is, Egypt had a faulty operational design. At the heart of Egypt's problem was its surface to air missile system employment. Current Army air and missile defense doctrine risks repeating the Egyptian's mistake. It lacks operational art cognition. The tools offered within current air and missile defense doctrine only serve tactical planning purposes as reflected in feedback from the Battle Command Training Program. Army air and missile defense can overcome this doctrinal shortcoming by adopting the operational design methodology provided in FM 3.0 and FM 5.0.

Recent events during Operation Iraqi Freedom indicate that air and missile defense planning and employment is capable of containing an operational art cognitive basis. Across the depth and width of the battlefield air and missile defense units protected the force *and* provided freedom of action. Mr. James Kitfield described a successful Patriot engagement of a Scud missile destined to impact 300 meters from the V Corps tactical operations center.[58] Numerous other reports recount similar engagements, but most striking are the bits and pieces less publicized in the national media. Moving rapidly with the V Corps main effort were elements of 11th Air Defense Artillery Patriot Brigade as part of the 3rd Infantry deep penetration to seize Baghdad.[59] This unit is normally an echelon above corps asset employed in static defense of high priority geo-political protected assets. Clearly air and missile defense was employed on a line of operation that nested with the overall system's aim that spanned a 300-mile depth. The fact that no missile engagements interfered with CENTCOM's freedom of action and air and missile defense successfully provided force protection indicates the air and missile defense plan contained sufficient operational art cognition nested within the overall operational design.

This was largely possible due the threat environment. Had the Iraqis possessed any capabilities beyond ballistic missiles and seriously challenged the coalition's control of the skies, events may have returned different results. None-the-less, the air and missile defense plan apparently accomplished its objectives that enabled the coalition to accomplish its military conditions and strategic aim.

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[58]James Kitfield, "The Army's Gamble", *National Journal*, 29 March 2003, 1.

Army air and missile defense planning and employment for Operation Iraqi Freedom appears to have operational art cognition. Future air and missile defense planners must benefit from this operation's lessons learned. Army air and missile defense doctrine still lacks the tools necessary to replicate this effort. With time those who developed and executed the Operation Iraqi Freedom plan will move on and take their expertise with them. If feedback from the Battle Command Training Program is used as an indicator, a majority of the Army air and missile defense community does not understand operational art. This necessitates correcting the operational art shortcomings of air and missile defense doctrine now by adopting the operational design methodology from FM 3.0 and FM 5.0.

[59]Lisa Rose Weaver, "5-52 ADA Reaches Baghdad Int'l – Sounds of Heavy Fighting in Distance" [article on-line]; available from http://www.kfoxtv.com/news/2096879/ detail.html; Internet; accessed on 6 May 2003.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

Conclusion

This monograph attempted to answer whether or not Army air and missile defense planning and employment--air and missile defense design--has an operational art cognitive foundation. In the final analysis evidence does not support operational art cognition within Army air and missile defense.

Systems theory is the foundation of operation art theory. It was determined that air and missile defense meets the systems evaluation criteria. It exhibits all the attributes of a complex adaptive system and, therefore, is capable of containing operational art cognition.

Current joint and service doctrine is consistent with operational art theory. The tools necessary to plan and employ forces within the operational art context are available in this doctrine. They are expressed by the operational design methodology, which was used as a basis for evaluating the 1973 War and current air and missile defense doctrine.

The October war illustrates an extremely valuable lesson for current air and missile defense planners. The Egyptian plan is an example of a system not based in operational art. It was a well-rehearsed set-piece battle with the surface to air missile defense system as its center of gravity. To Egypt's detriment, those that intuitively understood the adverse implications of keeping surface to air missile assets in a static

defense on the west side of the canal could not convince their superiors to advance east and provide depth to their plan. The problem was not poor communication skills. The problem began in 1967, when Egypt started to rebuild its military might and national pride. The lesson current air and missile defenders need to learn is that the system's aim determines everything else that follows. The Egyptian surface-to-air missile systems' aim was to protect Egypt from the formidable strength of the Israeli Air Force, at which it excelled. The system's aim, however, did not provide the Egyptian's with freedom of action to defeat the Israelis. In addition to the two operational art criterion listed above, center of gravity and system aim, the 1973 War also illustrates how the operational design evaluation criteria applies to air and missile defense.

Current US air and missile defense doctrine risks repeating the Egyptian's mistake. By emphasizing force protection as the primary purpose of Army air and missile defense, reinforced with a planning methodology based upon defended assets lists and forces available ratio, the current doctrine is devoid of operational design. Army air and missile defense contributes to the overall joint forces aim of air superiority and should focus on providing the commander with freedom of action as well as force protection as the desired overall military condition and end state.

Air and missile defense doctrine lacks sufficient basis for understanding and implementing operational art considerations as they apply to air and missile defense planning and employment. Current Army operational doctrine contains adequate tools for planning operations within the context of operational art. The elements of operational design as expressed in FM 3.0 are relevant to air and missile defense and must be contained in air and missile defense doctrine in both quantity and quality. Operational

design, the language of operational art, provides the link air and missile defense planning and employment needs to move from mere tactical engagements to a full-fledged contributor to the joint effort in attaining the military conditions required to satisfy the strategic aim.

Recommendations

In order to develop plans and employ systems at the operational level of war, air and missile defense doctrine must incorporate the operational design planning methodology provided from FM 3.0 and FM 5.0 into FM 44-100 and FM 44-94. The eleven operational design criteria used to assess operational art history and doctrine provide the tools necessary to give air and missile defense doctrine an operational art foundation. These operational design criteria and their relationship to air and missile defense are as follows.

JP 3.0 contains the tools necessary for conducting a system's aim analysis within its section dedicated to strategic estimate. The relevance to air and missile defense is linked to JP 3-01. Air superiority is the joint forces commander's desired aim for counterair forces. Therefore, air and missile defense planners consider the overall system's aim as provided from strategic estimate and determine how air and missile defense forces contribute to this aim through attaining and maintaining air superiority.

FM 3.0 defines the concept of end state and military conditions for operational planners. From JP 3-01 air and missile defense planners are presented the two broad desired counterair end states of force protection and freedom of action. Air and missile defense military conditions are then derived from these end states that are consistent with the overall operational design.

Air and missile defense doctrine should contain the concept of center of gravity from JP 3.0 and FM 3.0 with the addition of critical capabilities, critical requirements and critical vulnerabilities. This will enables air and missile defense planners to recognize how their capabilities contribute to the joint effort to defeat the threat system and preserve the friendly forces freedom of action.

The remaining seven operational design criteria are contained in FM 3.0 and FM 5.0. They are defense decisive points and objectives; lines of operation; culminating point; operational reach, approach, and pauses; simultaneous and sequential operations; linear and nonlinear operations; and tempo. These should be incorporated into FM 44-100 and FM 94-100 with the recognition that air and missile defense design must consider each of these in support of the overall operational design.

Until these eleven elements are adopted within U.S. Army air and missile defense doctrine, the U.S. Army and joint forces risk repeating Egypt's mistakes from the October War. This is an unacceptable risk that must not be eclipsed by recent success in Operation Iraqi Freedom. Operational art cognition is an imperative for the U.S. Army air and missile defense community and must be solidified in its doctrine.

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